

**VeriSilicon GSMC 0.15 μ m
Synchronous Diffusion ROM
Compiler User's Guide**



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chapter 1 Introduction

1.1 Compiler Description

VeriSilicon GSMC 0.15 μ m Synchronous Diffusion ROM compiler optimized for Grace Semiconductor Manufacturing Corporation (GSMC) 0.15 μ m Logic 1P7M Salicide 1.5/3.3V process can flexibly generate memory blocks by a friendly GUI or shell commands.

The compiler supports comprehensive range of word length and bit length. While satisfying speed and power requirements, it was optimized for area efficiency.

VeriSilicon GSMC 0.15 μ m Synchronous Diffusion ROM compiler uses three metal layers within the blocks and supports metal 4, 5, 6 or 7 as the top metal. Dummy bit cells are designed in with the intention to enhance reliability.

1.2 Features

- High Density
- High Speed
- Size Sensitive Self-time Delay for Fast Access Time and "Zero" Hold Time
- Automatic Power Down

1.3 Operating Conditions

The following table gives the recommended operating conditions for memory blocks generated by ROM compiler:

Operating Conditions	Parameter	Rating
Supply Voltage	1.5V	1.35V to 1.65V
Temperature	25°C	0°C to 125°C

1.4 Pin Descriptions

The following table gives detailed information of pin descriptions for ROM (Bus index descending ordered):

Pin	Description
DOUT[i]	Data output
AD[i]	Address input
CEN	Chip enable input, low enable
CLK	CLK input, positive edge active
OE	Output enable, high enable

1.5 Parameter Range

Parameter	Range		
Memory Array Range	128 to 2M Bits		
Data Width	2 to 128 Bits, Increments of 1		
ROM Address Depth	64 to 32768 Words, Increments of (8 X Column Mux)		
Column Mux	The following lists the changes of width and height when column mux is set to different values. Suppose when column mux is 16, the width and height is a standard.		
		Width	Height
	8	1/2	2
	16	1	1
	32	2	1/2
Top Metal	m4, m5, m6 or m7		
Output Drive Strength	The same drive as INVVD8X cell in VeriSilicon GSMC 0.15μm High-Density Standard Cell Library		

1.6 ROM Floor Plan

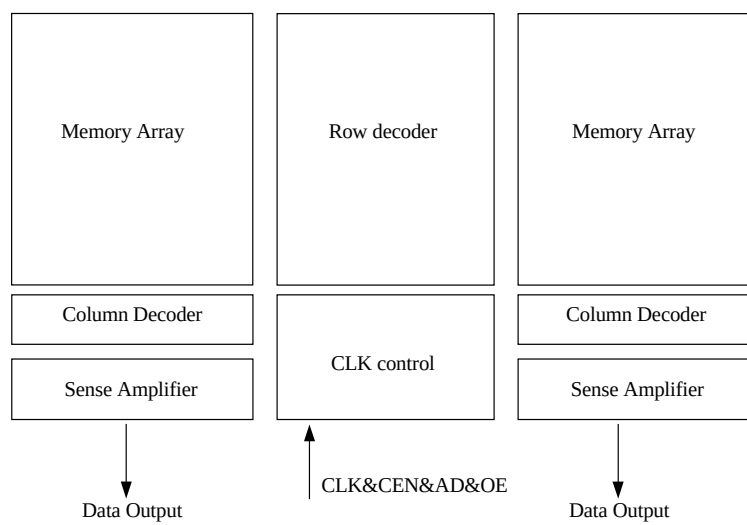


Fig.1 ROM Floor Plan

chapter 2 Timing Diagram

2.1 Timing Specifications for Diffusion ROM

This section specifies the timing specifications for the diffusion ROM.

Fig.2 gives the read function timing diagrams of diffusion ROM.

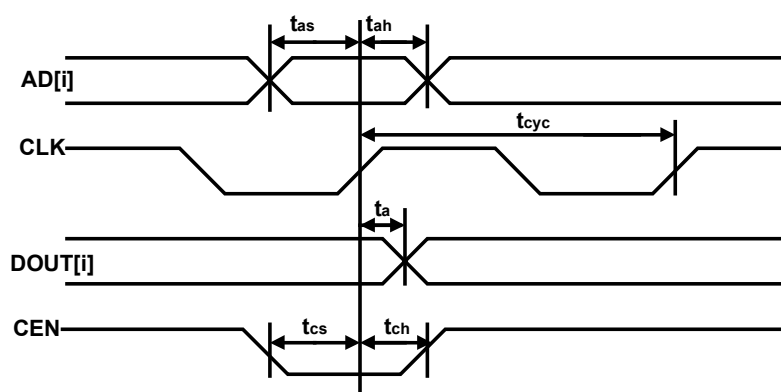


Fig.2 Read-Function Timing

Fig.3 gives the diffusion ROM output enable timing diagrams:

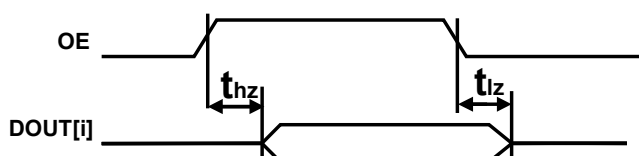


Fig.3 Output-Enable Function Timing

Timing Parameters

The following table specifies the timing parameters in the datasheet generated by the ROM compiler:

Timing Parameters

Parameter	Symbol
Cycle time	t _{cyc}
Access time*	t _a

Address setup time	t_{as}
Address hold time	t_{ah}
Chip enable setup time	t_{cs}
Chip enable hold time	t_{ch}
Output enable to hi-Z time	t_{l_z}
Output enable active time*	t_{hz}

* Parameters values are load dependent.

Power Parameters

The following table specifies the power parameters in the datasheet generated by the ROM compiler:

Power Parameters

Parameter	Symbol
Average current	i_{avg}
Peak current	i_{peak}

i_{avg} is the average current in A/100MHz unit. The average current in the datasheet is achieved under below assumption:

1. Input net transition is 0.2ns.
2. Output port capacitance is 0pF.

The total average current of the memory than can be estimated according following equation:

$$I_{avg} = i_{avg} * F + 1/2 * C * V * f * N$$

Where,

I_{avg} : the total average current of the memory. (A)

F: the frequency of clock. (100MHz)

C: the average capacitance of output port. (F)

V: the voltage supply. (V)

f: the frequency of output port. (Hz)

N: switched ports number.

i_{peak} is the peak current of memory during operation in A unit.

chapter 3

Using the ROM Compiler

3.1 System Requirement

Before installation, make sure that the following minimum host configuration is available:

- Sun Microsystem's Solaris7

3.2 Software Environment

The ROM compiler requires UNIX and X-Window as its GUI was developed with Motif.

3.3 Installing ROM Compiler

To install ROM compiler, please follow the instructions bellow:

1. Create an installation directory where you wish to install the ROM compiler.

NOTE

<install_dir> will stand for the directory you have created for installation hereafter.

2. `cd <install_dir>`
3. `gunzip < <release_compressed_file> | tar xvf -`
4. Copy .vsmcrc file to the home directory.
5. Add the following to .cshrc file.

```
source ~/.vsmcrc
```

6. Modify .vsmcrc file as the following and source it:

```
setenv VERISILICON_MC_DIR <install_dir>
```

After successful installation, the following directory structure will be created under *<install_dir>*:

gsmc_drom.15

This directory contains the technology files and library files of the ROM

compiler.

The following table lists the names of the executable files in the installation directory and its description:

Name	Description
MC	The executable file of ROM compiler.

NOTE

Be sure not to edit any files in <install_dir> directory.

3.4 Inputs and Outputs

The ROM compiler allows users to define the following input parameters for a specific ROM block:

Library
Running Directory
Block Name
Number of Words
Number of Bits
Ring Width
Frequency (MHz) (no use now)
ROM Code File
Multiplexer Width
Horizontal Ring Layer
Vertical Ring Layer
Top Metal Layer

The ROM compiler generates the following output files.

GDSII Layout File (GDSII format)
LVS Netlist (CDL format)
Verilog Model Code
VHDL Model Code
TLF Timing
Synopsys Model
Datasheet
ROM code file
LEF view

Antenna LEF view

Antenna CLF model

After inputting the parameters, users should wait a few minutes for the outputs to be generated by the ROM compiler automatically.

3.5 Getting Started

There are two ways to start ROM compiler as follows:

Using Shell Commands

Users can launch ROM compiler using commands line in the shell window. Enter the following commands to launch the ROM compiler directly from the shell:

```
% cd <running_dir>
```

```
% MC [options with parameters]
```

The *<running_dir>* is the directory which the ROM compiler run in. All the outputs will be generated in this directory.

Make sure that the running directory *< running_dir>* is different from the installation directory *<install_dir>*.

The following options can be specified in the command line:

```
-lib $lib_dir  
-outdir $run_dir  
-block $mem_name  
-wordsnumber $memlength  
-bitsnumber $datawidth  
-ringwidth $ringwidth  
-muxwidth $varMuxWidth  
-vlayer $varVLayer  
-hlayer $varHLayer  
-frequency $frequency (no use now)  
-codefile $codefile  
-topmetal $topmetal  
-area y/n
```

Please see section **Parameters under GUI and Shell Commands** for details explanation.

Example:

```
MC -lib gsmc_drom.15 -block DROM2048X16 -wordnumber 2048
-bitnumber 16 -muxwidth 16 -vlayer m3 -hlayer m4 -frequency 100 -codefile
DROM2048X16 -topmetal m4
```

This command will generate a ROM name of DROM2048X16, with 2048 words, 16 bits, 16 column multiplexer width, frequency 100MHz, metal layer 3 as the vertical ring layer, metal layer 4 as the horizontal ring layer, and metal layer 4 as the top metal layer according to the code file DROM2048X16.

Using Graphical User Interface (GUI)

We provide a friendly GUI to enable the users to configure parameters and generate all the outputs in the directory specified. From the shell, type the commands as follows:

```
% cd <running_dir>
```

```
% MC
```

Click on the *browse* button to select the ROM's library, then the following GUI window for ROM compiler will appear on your screen:



Fig.1 the ROM Compiler GUI

Fill content in the blank for each option and click the proper button, you will get your results.

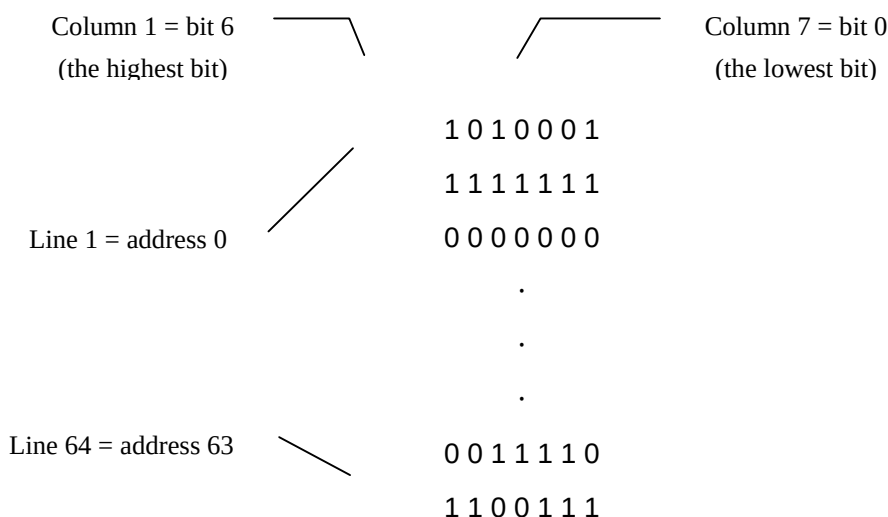
Parameters under GUI and Shell Commands

The section specifies detailed descriptions of the parameters of the ROM compiler and their corresponding default value:

Parameter under Shell Commands	Parameter under GUI	Description		
-lib	Library	Specify the library directory used by the Register File compiler. You can click on the <i>browse</i> button to find the valid library you have installed.		
-rundir	Running Directory	Specify the output directory of the ROM compiler. The directory name can be any valid path name supported by the system. The default is current directory.		
-block	Block Name	Specify the block name. The block name can include any alphanumeric value and must be unique to avoid name conflicts for blocks within the same library. It is recommended that a block name is no more than 16 characters, for we will identify two blocks by their first 16 letters. The default is DROM4096X32M8.		
-wordsnumber	Number of Words	Specify the number of words in the block. The default value is 4096. The range for words can be 64 to 32768. The following gives the detailed information:		
		Mux	Number of words	Increment
		8	64 to 8192	Mux * 8
		16	128 to 16384	Mux * 8
		32	256 to 32768	Mux * 8
-bitsnumber	Number of Bits	Specify the number of bits in the block. The default value is 32. The range for bits can be 2 to 128. The following gives the detailed information:		
		Mux	Number of Bits	Increment
		8	2 to 128	1
		16	2 to 128	1
		32	2 to 64	1
-ringwidth	Ring Width	Specify the ring width of the block in um. The default value is 5. The minimum is 2. The designer must decide the ring width according the power analysis.		
-frequency	Frequency	Specify the frequency of the clock of the chip in MHz. The default value is 100MHz. It dose not affect anything now, and it is just reserved for future usage.		

-codefile	CodeFile	Specify the code file of the ROM. Please refer to the following figure for detailed information about the code file format. If customer doesn't specify the code file or the code file he specifies doesn't exist, all the bits of the ROM block will be set to 1 automatically. The default is NOCODE.
-muxwidth	Multiplexer Width	Specify the column multiplexer width. The default value is 8. There are three buttons for your choice: 8, 16, or 32. When this option is set to different values, the width and height of the block will change correspondingly. For detailed information, please refer to Parameter Range section on page 5.
-vlayer	Vertical Ring Layer	Specify which metal layer will be the vertical ring layer. It can only be m4.
-hlayer	Horizontal Ring Layer	Specify which metal layer will be the horizontal ring layer. It can only be m3.
-topmetal	Top Metal Layer	Specify the top metal layer. It can be m4, m5 or m6. The default value is m4.
-area	y/n	Once "-area y" is used, the compiler will only generate a width X height report. Default is n.

The following illustrates the format of code file of a ROM name of DROM64 × 7, with 64 words, 7 bits:



Each character of a line indicates the bit of a word.

3.6 Generating the Outputs

When you click on the *Default* button in the GUI window, the ROM compiler will automatically load the default parameters of the ROM and generate the ROM based on the default parameters.

To generate the outputs, click on *Generate* button. All the outputs are

generated according to the generic parameters you set and place in the user specify *running* directory *<running_dir>*.

The following table lists the detailed description of the output files:

Name	Description
*.tlf	TLF Model
*.lib	Synopsys Model
*.net	Cdl netlist
*.gds	GDS file
*.ds	Datasheet
*.v	Verilog Model
*.vhd	VHDL Model
*.dat	Rom Code File
*.lef	LEF view
*_antenna.lef	Antenna LEF view
*_antenna.clf	Antenna CLF model

And click on *Exit* button to quit the ROM compiler.